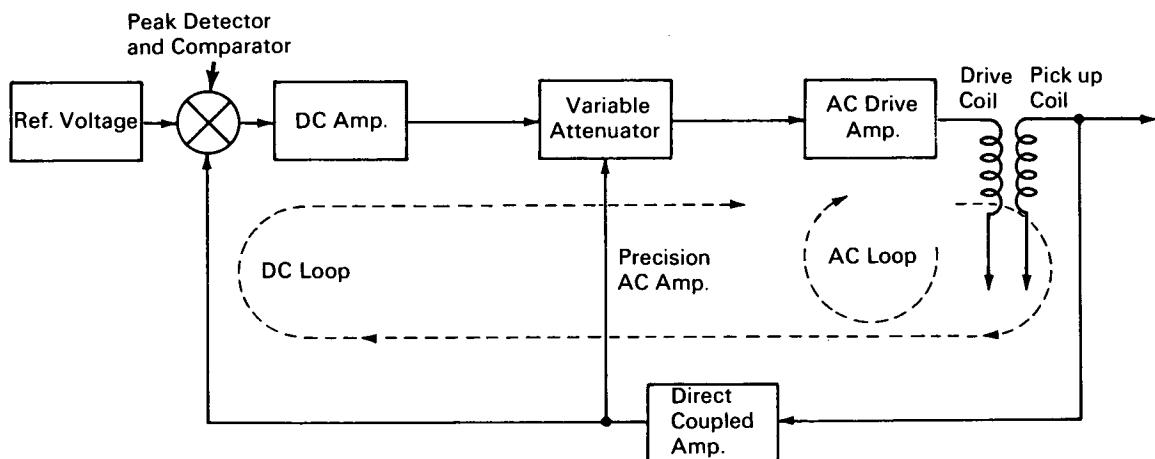


# NASA TECH BRIEF



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## System Precisely Controls Oscillation of Vibrating Mass



A system is designed to precisely control the sinusoidal amplitude of a vibrating mechanical mass. The system uses two sets of coils, one as a driving coil and one as a pickup or sensing coil, mounted to the rigid frame of the system. Two small permanent magnets are mounted on the mass to be vibrated so they move inside the coils in close proximity to their electromagnetic fields. Amplitude information is obtained from the pickup coil, amplified, and compared with a preset electronic reference that provides an error signal that can be used to determine the amplitude of the drive signal. When the mechanical mass reaches the desired vibrational amplitude, the drive signal amplitude is regulated at the precise level to maintain it.

In operation, a small drive signal will appear at the drive coil during initial startup, initiating vibration of the mass. Due to the high Q mechanical resonance of the system at 40 cps, it will vibrate primarily at that frequency. A portion of the vibration signal is

sensed by the pickup coil and amplified in the three-stage direct coupled amplifier. This signal passes through the variable attenuator without attenuation since the amplitude at the peak detector is less than 5 volts peak-to-peak, the threshold of the entire amplitude regulating loop. The signal is amplified further in the ac drive amplifier and increases the amplitude of mass oscillation until a peak-to-peak amplitude of 1 degree is reached. As the peak signal exceeds 5 volts, the peak detector begins passing the extreme peaks of the sinewave. This peak current is then amplified and filtered. The resulting dc voltage causes a dc current to flow through the variable attenuator, whose diodes appear in series for dc but are seen as back-to-back or in parallel by an ac signal. This configuration minimizes distortion introduced by the nonlinear characteristics of the diodes.

The dc current through the diodes reduces their dynamic resistance, resulting in attenuation of signal from the precision ac amplifier and delivery of a lower

(continued overleaf)

signal to the drive coil. The ac signal across the attenuator is reduced to a gain about the entire ac loop exactly equal to one. If the amplitude tends to rise, the regulator loop will decrease the ac loop gain, and if the amplitude tends to fall, the regulator loop will increase the ac loop gain. The ac signal from the attenuator is amplified in the drive amplifier and direct coupled to the drive coil.

**Notes:**

1. This technique could be used to vibrate mirrors in an optical chopping application.
2. Inquiries concerning this invention may be directed to:

Technology Utilization Officer  
Marshall Space Flight Center  
Huntsville, Alabama 35812  
Reference: B67-10276

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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